



Docket No.: 21806-00085-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Brian C. Barker, et al.

Confirmation No.: 3261

Application No.: 09/527,761

Filed: March 17, 2000

Art Unit: 2876

For: WAFER IDENTIFICATION MARK

Examiner: S. Lee

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APPELLANT'S BRIEF

MS Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

October 6, 2003 (Monday)

Dear Sir:

This brief is in furtherance of the Notice of Appeal, filed in this case on August 4, 2003, making this Appellants' Brief due on or before Monday, October 6, 2003.

The fees required under § 1.17(f) and any required petition for extension of time for filing this brief and fees therefor, are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief is transmitted in triplicate.

This brief contains items under the following headings as required by 37 C.F.R. § 1.192 and M.P.E.P. § 1206:

- I. Real Party In Interest
- II. Related Appeals and Interferences
- III. Status of Claims
- IV. Status of Amendments
- V. Summary of Invention
- VI. Issues
- VII. Grouping of Claims
- VIII. Arguments

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IX. Claims Involved in the Appeal
App. A Claims

I. REAL PARTY IN INTEREST

The real party in interest for this appeal is:

International Business Machines Corporation, Armonk, New York USA

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A. Total Number of Claims in Application: There are 67 claims pending in the application.

B. Current Status of Claims:

1. Claims canceled: none
2. Claims withdrawn from consideration but not canceled: none
3. Claims pending: 1-67
4. Claims allowed: 27 (if rewritten in independent form)
5. Claims rejected: 1-26 and 28-67

C. Claims On Appeal: The claims on appeal are claims 1-26 and 28-67.

IV. STATUS OF AMENDMENTS

In response to the Final Official Action mailed September 11, 2002, Appellants filed an Amendment After Final Rejection under 37 C.F.R. § 1.116 on November 12, 2002. The Examiner then withdrew the finality of the rejections by responding to the Amendment After Final Rejection with a new, Non-Final Official Action mailed January 14, 2003. In this Non-Final Action, the Examiner repeated, verbatim, the numerous rejections in the Final Official

Action mailed September 11, 2002, with the only modification being the withdrawal of the indicated allowability of claims 57 and 62.

Appellants then filed an Response under 37 C.F.R. § 1.111 on March 17, 2003 setting forth arguments, and no amendments to the claims. In the Response, believed procedural defects in the Non-Final Official Action mailed January 14, 2003 were pointed out which were asserted by the undersigned as precluding the finality of the next Official Action.

The Examiner then issued a new, Non-Final Official Action mailed June 18, 2003. In this Non-Final Action, the Examiner repeated, verbatim, the rejections in the Non-Final Official Action mailed January 14, 2003, which replicated the numerous rejections in the Final Official Action mailed September 11, 2002, with the only new modification being the objection to claim 27, which was solely indicated as being allowable if rewritten in independent form.

Thus, after the prosecution outlined above, claims 1-26 and 28-67 now stand rejected at least twice, and claim 27 is indicated as being allowable if rewritten in independent form. Therefore, since the claims on appeal have been twice rejected, even if not currently under Final Rejection, the application is in condition for appeal.¹

Accordingly, the claims 1-67 enclosed herein as Appendix A incorporate all previously entered amendments, and are believed to correctly list claims 1-26 and 28-67 which are the claims on appeal.

V. SUMMARY OF INVENTION

A. Introductory Remarks

This optional, introductory subsection is provided as an aid to the Examiner and the Honorable Board to provide an overview of the invention, without specific reference to Specification page and line numbers. Specific reference to page and line numbers in the Specification which provide enabling disclosure of the claimed invention, is provided in

¹ See 37 CFR 1.191(a) and MPEP §1205.

subsection "B" of this Summary of the Invention Section, as required by the MPEP and 37 C.F.R. §1.192.

In general, the claimed invention provides techniques for encoding any desired information on a semiconductor wafer. The disclosed and claimed invention provides structures for encoding information on a semiconductor wafer as well as a method for forming the structures and for retrieving the information encoded in the structures. Any information may be encoded in the structures.

In general, information-encoding structures on a semiconductor wafer according to the claimed invention include a plurality of information-encoding pits in the semiconductor wafer. The pits may be formed in any part of the semiconductor wafer. In other words, the pits may be formed on a top surface of the semiconductor wafer, on a bottom surface of the semiconductor wafer, and/or on side surfaces of the semiconductor wafer. The pits are arranged in an information-providing pattern, and are readable after completion of processing on the wafer. As described below, any number of patterns may be utilized according to the disclosed and claimed invention.

Arrangements of the information-providing pattern of the pits according to the claimed invention can include a digital pattern, alphanumeric pattern, and/or any other desired pattern. If the pits are arranged in a digital pattern, the pattern could comprise pits having two different lengths. The pits could be provided on any surface of the semiconductor wafer. Along these lines, the pits could be provided on a front surface, back surface and/or side surface such as the edge, of the semiconductor wafer.

Pits according to the claimed invention could be readable in one or more ways. For example, the pits could be readable to the naked human eye. The pits could also be readable by a reading device. Along these lines, a laser-reading device could be utilized to read information encoded in pits according to the disclosed and claimed invention. The pits could be machine-readable.

Pits according to the claimed invention could be formed in any one or more of a variety of shapes, sizes, and arrangements relative to each other. Along these lines, each pit could be formed having the same or different shapes and/or depths. For example, all of the pits could have a general circular shape. All the pits could also have a square, generally square, rectangular and/or any other shape. The pits may also be formed such that all of the pits do not have the same shape.

As stated above, binary information could be encoded in pits having two different shapes. Binary information could also be encoded in pits all having the same shape with the lack of a pit forming the second value in the binary information.

If the pits do not all have the same shape, they could have different widths and/or lengths, such as where the pits are rectangles having different lengths, as well as where the pits have different overall shapes. Typically, the pits would have at least two different widths, lengths, or shapes. In some cases, all of the pits have the same length but different widths or the same width and different lengths.

Currently, semiconductor wafers are identified by bar codes. Typically, a laser is utilized to create a bar code on semiconductor wafers to identify the semiconductor wafers. However, a laser scribed bar code typically cannot be read after process steps. In the past, to improve the readability of a laser scribed bar code, a rectangle has been implanted before scribing to improve the contrast. The bar code may then be scribed on the implanted rectangle. When the bar code becomes unreadable, a special reader has been required to read the bar code. This permits a tool reader to read the bar code.

As an alternative to imprinting a bar code on an implanted region, materials have been deposited in and on the wafers to change the contrast of the wafer relative to the bar code. However, such deposited films are attacked during subsequent processing.

Typically, multiple manufacturing tools run wafer lots of multiple product design and multiple engineering change (EC) levels, or versions of specific products. Lot numbers on a

transport box may control the wafer lots. It often is important to track wafers to ensure the correct wafer receives the correct process. Tracking may be carried out with the bar code described above. However, as stated above, the bar code may become unreadable. Additionally, current semiconductor fabrication control systems require a data system that identifies wafers and lots and downloads the proper tool recipes. In many cases different wafers within a lot may require different processing. This is also based on lot and wafer identity. Thus, correctly identifying routing and processing wafers is very important. Correctly identifying routing and tool recipe is very important for successful semiconductor fabrication.

Future processing advances include 300 millimeter or larger wafer fabricators. As such fabricators come online, it is expected that multiple part numbers will exist within wafer lots. This will further complicate control requirements. Along these lines, even more importance will be placed on wafer tracking systems.

The disclosed and claimed invention provides solutions to the above and other problems by providing a scheme for permitting a wafer to be identified. Identification of the wafer can permit determination of the structures formed thereon.

Additionally, the disclosed and claimed invention can provide a reliable method for identifying wafers during fabrication and permitting quick matching of a wafer to a lot, a wafer to a process tool and/or a process recipe, among other things. The disclosed and claimed invention is more reliable than currently utilized bar code systems.

The disclosed and claimed invention can also provide a reliable method of controlling wafers during fabrication permitting tracking of a wafer to a lot, wafer to a process, and a wafer to a process recipe, among other things. The disclosed and claimed invention may also reduce tool and logistical control system expenses by moving certain control functions to a local level. Again, the disclosed and claimed invention may carry out these functions with greater reliability than currently utilized bar code systems.

The disclosed and claimed invention addresses shortcomings of currently utilized wafer processing systems by providing a system that can survive wafer processing to be readable by human eyes, whether assisted or not, or by machine. The disclosed and claimed invention also provides methods that can provide several orders of magnitude increase in the amount of information available on a wafer as compared to a common or standard bar code. The information provided on semiconductor wafers according to the disclosed and claimed invention could further be utilized to locally control tools in addition to providing wafer identification data.

The disclosed and claimed invention can be utilized to accomplish a variety of different goals. For example, the disclosed and claimed invention can permit determination of position of a wafer in a boule as well as the identification of a wafer for the purposes for determining the structures formed thereon. Also, the disclosed and claimed invention can permit identification the position of one wafer in a boule relative to other wafers cut from the same boule. The disclosed and claimed invention can also permit tracking and routing of semiconductor wafers and manufacturing processes. Any other use for information encoded on a semiconductor wafer may also be carried out according to the disclosed and claimed invention.

B. Disclosure Relating to the Claimed Embodiments

Various embodiments and aspects of the claimed invention are discussed below with reference to page and line numbers of the Specification, as optionally suggested by the MPEP.

In the embodiment claimed in independent claim 1, a semiconductor wafer includes a plurality of pits in the semiconductor wafer which are arranged in a digital information-providing pattern (See Specification p. 10, line13 through p. 11, line 6). The digital information-providing pattern is arranged in a pattern other than a bar code pattern (See Specification p. 11, lines 1-3). The digital information-providing pattern is arranged and adapted to be readable before, during and after completion of processing on the wafer (See Specification p. 10, lines 18-20).

In other aspects of this embodiment claimed in dependent claim 7, the digital pattern comprises long and short pits (See Specification p. 12, lines 6-10). More generally in dependent

claim 8, the plurality of pits comprise pits of a first shape and pits of a second shape (See Specification p. 11, line 21 through p. 12, ,line 4).

In other aspects of this embodiment claimed in dependent claim 21, the pits have at least two different widths (See Specification p. 12, lines 8-10).

In other aspects of this embodiment claimed in dependent claim 32, the pits comprise at least one location pit for providing locational reference to a plurality of informational pits, wherein the location pit is arranged in a side edge of the wafer and the informational pits are located in a top surface or a bottom surface of the wafer (See Specification p. 15, line 20 through p. 16, line 4). In other aspects of this embodiment in dependent claim 33, the pits have the same widths and at least two different lengths (See Specification p. 12, lines 6-10) and, in dependent claim 34, the pits may be arranged in at least one line (See Specification p. 15, lines 15-18).

In other aspects of this embodiment claimed in dependent claim 36, the wafer may have a sapphire or silicon carbide coating on the surface of the pits (See Specification p. 15, lines 8-13 and p. 39, lines 3-8).

In another embodiment of the invention claimed in independent claim 37, a method of encoding information on a semiconductor wafer includes converting the information into a digital form other than a bar code pattern (See Specification p. 16, lines 10-13). The pits are formed to be suitable for being read before, during and after completion of processing on the wafer corresponding to the digital form of the information in the semiconductor wafer (See Specification p. 10, lines 18-20).

In another aspect of this embodiment claimed in dependent claim 38, forming the pits includes forming a line of pits having two different lengths, where the line of pits corresponding to the digital form of the information (See Specification p. 15, lines 15-18).

In another aspect of this embodiment claimed in dependent claim 40, the pits are provided with a detectable contrast with respect to surrounding portions of the wafer (See Specification p. 14, line 20 through p. 15, line 6).

In another aspect of this embodiment claimed in dependent claim 44, the information represented by the pits is read with a machine. In an aspect of this embodiment claimed in dependent claim 45, the information represented by the pits may be read by an unaided human eye (See Specification p. 11, lines 8-12).

In an aspect of this embodiment claimed in dependent claim 47, the pits are formed during wafer processing to record information about the processing (See Specification p. 18, lines 4-10).

In an aspect of this embodiment claimed in dependent claim 49, the method also includes reading pits formed during processing and using the information read to determine a subsequent process parameter (See Specification p. 38, lines 10-20).

In an aspect of this embodiment claimed in dependent claim 55, the plurality of pits are simultaneously arranged in both the digital information-providing pattern and a human-readable pattern (See Specification p. 34, lines 3-6 and FIG. 12).

In other aspects of this embodiment claimed in dependent claim 60, the method further comprises simultaneously arranging the pits to correspond both to the digital form and to a human-readable pattern (See Specification p. 34, lines 3-6 and FIG. 12).

In other aspects of this embodiment claimed in dependent claim 63, the step of converting the information into the digital form includes converting the information into a non-binary digital form, and the step of forming pits includes forming pits in a plurality of differently oriented oval pits as defined by an orientation of each of an associated major axis thereof (See Specification p. 11, line 14 through p. 12, line 2, and implicitly by use of a plurality of shapes).

In another embodiment of the invention claimed in independent claim 51, a system for encoding information on a semiconductor wafer and reading the information includes a plurality of pits formed on the semiconductor wafer in a digital information-providing pattern other than a bar code pattern (See Specification p. 11, lines 1-3). The digital information-providing pattern is adapted and arranged to be readable before, during and after completion of processing on the

wafer (See Specification p. 10, lines 18-20). The system also includes means for reading the information encoded by the pits, e.g., a laser reader (See Specification p. 35, lines 1-2 and p. 39, lines 10-13).

In another aspect of this embodiment claimed in dependent claim 54, the information reading means comprises at least one linear diode array (See Specification p. 27, lines 4-6).

In other aspects of this embodiment claimed in dependent claim 64, the plurality of pits are simultaneously formed in the digital information-providing pattern and in a human readable form (See Specification p. 11, lines 8-12).

In an embodiment of the invention claimed in independent claim 57, a semiconductor wafer includes a plurality of pits in the semiconductor wafer arranged in a digital information-providing pattern other than a bar code pattern (See Specification p. 11, lines 1-3). The digital information-providing pattern is readable before, during and after completion of processing on the wafer (See Specification p. 10, lines 18-20). In this embodiment, the digital information-providing pattern is a non-binary coded pattern, and the plurality of pits comprises pits having at least three different shapes including a circle, an oval, and a rectangle (See Specification p. 12, lines 1-2).

In an embodiment of the invention claimed in independent claim 62, a method of encoding information on a semiconductor wafer includes converting the information into a digital form other than a bar code pattern (See Specification p. 11, lines 1-3). The pits are formed to be readable before, during and after completion of processing on the wafer corresponding to the digital form of the information in the semiconductor wafer (See Specification p. 10, lines 18-20). Also, the step of forming pits includes forming pits in the shape of a circle, an oval, and a rectangle (See Specification p. 12, lines 1-2).

VI. ISSUES

- A. Has the Examiner established that every recited feature of claims 1, 2, 6, 9, 13, 22, 22, 37, 40, 43-45, 51, 54, 55, 58, 60, 63, and 64 is disclosed by Bacchi et al. (US 5,894,348), and is therefore anticipated under 35 U.S.C. §102(e)?
- B. Has the Examiner established a *prima facie* case of unpatentability of claims 7, 8, 10, 16, 21, 28-30, 33-35 and 38 over Bacchi et al. (US 5,894,348) in view of Duncan (US 4,585,931), such that these claims are unpatentable under 35 U.S.C. §103(a)?
 - 1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
 - 2. Has the Examiner established the proper motivation to combine Bacchi et al. with Duncan in the manner suggested, given that Duncan specifically teaches against at least one aspect of the invention claimed in these claims?
- C. Has the Examiner established a *prima facie* case of unpatentability of claims 11, 12, 17-19, and 41 over Bacchi et al. (US 5,894,348) in view of Young et al. (US 5,792,566), such that these claims are unpatentable under 35 U.S.C. §103(a)?
 - 1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
 - 2. Has the Examiner established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Young et al. in the manner suggested, given that Young et al. is directed to the solution of a completely different technical problem than Appellants' claimed invention?
- D. Has the Examiner established a *prima facie* case of unpatentability of claims 23-26 over Bacchi et al. (US 5,894,348) as modified by Duncan (US 4,585,931), in view of Young et al. (US 5,792,566), such that these claims are unpatentable under 35 U.S.C. §103(a)?

1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
2. Has the Examiner established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Duncan and further with Young et al., given that Duncan specifically teaches against at least one aspect of the claimed invention, and that Young et al. is directed to the solution of a completely different technical problem than Appellants' claimed invention?

E. Has the Examiner established a *prima facie* case of unpatentability of claims 14 and 52 over Bacchi et al. (US 5,894,348) in view of Yano et al. (US 6,268,641), such that these claims are unpatentable under 35 U.S.C. §103(a)?

1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?

F. Has the Examiner established a *prima facie* case of unpatentability of claims 15, 36, and 42 over Bacchi et al. (US 5,894,348) in view of Brown et al. (US 5,976,768), such that these claims are unpatentable under 35 U.S.C. §103(a)?

1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
2. Has the Examiner established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Brown et al., given that Brown et al. is directed to the solution of a completely different technical problem than Appellants' claimed invention?

G. Has the Examiner established a *prima facie* case of unpatentability of claims 20, 31, 32, and 39 over Bacchi et al. (US 5,894,348) in view of Iwai (US 4,418,567), such that these claims are unpatentable under 35 U.S.C. §103(a)?

1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?

H. Has the Examiner established a *prima facie* case of unpatentability of claim 53 over Bacchi et al. (US 5,894,348) in view of Makinouchi et al. (US 4,958,082), such that these claims are unpatentable under 35 U.S.C. §103(a)?

1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
- I. Has the Examiner established a *prima facie* case of unpatentability of claims 46-50 over Bacchi et al. (US 5,894,348) in view of Moh et al. (US 6,214,250), such that these claims are unpatentable under 35 U.S.C. §103(a)?
 1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
 2. Has the Examiner established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Moh et al., given that Moh et al. is directed to the solution of a completely different technical problem than Appellants' claimed invention?
- J. Has the Examiner established a *prima facie* case of unpatentability of claims 3-5 over Bacchi et al. (US 5,894,348) and Moh et al. (US 6,214,250) in view of Huang et al. (US 5,330,924), such that these claims are unpatentable under 35 U.S.C. §103(a)?
 1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
 2. Has the Examiner established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Moh et al. and Huang et al., given that both Moh et al. and Huang et al. are directed to the solution of completely different technical problems than Appellants' claimed invention, and also different technical problems from each other?
- K. Has the Examiner established a *prima facie* case of unpatentability of claim 59 over Bacchi et al. (US 5,894,348) in view of Wen (US 5,834,819), such that these claims are unpatentable under 35 U.S.C. §103(a)?

1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
2. Has the Examiner established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Wen, given that Wen is directed to the solution of a completely different technical problem in a completely different way than Appellants' claimed invention?

L. Has the Examiner established a *prima facie* case of unpatentability of claims 56, 57, 61, and 62 over Bacchi et al. (US 5,894,348) in view of Zhang (US 5,245,165), such that these claims are unpatentable under 35 U.S.C. §103(a)?

1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?
2. Has the Examiner established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Zhang, given that Zhang is directed to the solution of a completely different technical problem in a completely different way than Appellants' claimed invention?

M. Has the Examiner established a *prima facie* case of unpatentability of claims 65-67 over Bacchi et al. (US 5,894,348) in view of Grandia et al. (US 4,084,354), such that these claims are unpatentable under 35 U.S.C. §103(a)?

1. Has the Examiner established that the suggested combination teaches or suggests all the claimed limitations?

VII. GROUPING OF CLAIMS – SEPARATE ARGUMENTS FOR PATENTABILITY

For purposes of this appeal brief only, and without conceding the teachings of any applied art reference, *separate arguments for patentability are presented* as follows:

- A. Claims 37, 40, 45, and 63 do not stand or fall together with independent claims 1 or 51, or with dependent claims 2, 6, 9, 13, 22, 22, 43, 44, 54, 55, 58, 60, and 64.
- B. Claims 51 and 54 do not stand or fall together with independent claims 1 or 37, or with dependent claims 2, 6, 9, 13, 22, 22, 37, 40, 43-45, 55, 60, and 63.
- C. Claims 55, 60 and 64 do not stand or fall together with independent claims 1, 37 or 51, or with dependent claims 2, 6, 9, 13, 22, 22, 40, 43-45, 54, 58, and 63.

- D. Claims 8, 21, 33, and 38 do not stand or fall together with dependent claims 7, 10, 16, 28-30, 34, and 35.
- E. Claims 47 and 49 do not stand or fall together with dependent claims 46 and 48.
- F. Claims 57 and 62 do not stand or fall together with dependent claims 56 and 61.

In Section VIII below, Appellants have included separate arguments supporting the separate patentability of each set of claims identified above, as required by M.P.E.P. §1206.

VIII. ARGUMENTS

- A. **The Examiner has not established that every limitation recited in claims 1, 2, 6, 9, 13, 22, 22, 37, 40, 43-45, 51, 54, 55, 58, 60, 63, and 64 is disclosed by Bacchi et al. (US 5,894,348), so that the anticipation rejection under 35 U.S.C. §102(e) is not sustainable, and should be reversed.**

Reversal of the rejection of claims 1, 2, 6, 9, 13, 22, 37, 40, 43-45, 51, 54, 55, 58, 60, 63, and 64 under 35 U.S.C. §102(e) as being anticipated by Bacchi et al. (US 5,894,348) is requested.

Appellants note that anticipation requires the disclosure, in a prior art reference, of each and every limitation as set forth in the claims.² There must be no difference between the claimed invention and reference disclosure for an anticipation rejection under 35 U.S.C. §102.³ To properly anticipate a claim, the reference must teach every element of the claim.⁴ “A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference”.⁵ “The identical invention must be shown in as complete detail as is contained in the ...claim.”⁶ In determining anticipation, no claim limitation may be ignored.⁷ In view of the foregoing authority, the cited reference at least fails to anticipate independent claims 1, 37, and 51 as originally presented, and as amended.

² *Titanium Metals Corp. v. Banner*, 227 USPQ 773 (Fed. Cir. 1985).

³ *Scripps Clinic and Research Foundation v. Genentech, Inc.*, 18 USPQ2d 1001 (Fed. Cir. 1991).

⁴ See MPEP § 2131.

⁵ *Verdegaal Bros. v. Union Oil Co. of Calif.*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

⁶ *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

⁷ *Pac-Tex, Inc. v. Amerace Corp.*, 14 USPQ2d 187 (Fed. Cir. 1990).

In particular, Bacchi et al. does not disclose a semiconductor wafer, which includes, among other features, “a plurality of pits in the semiconductor wafer, the pits being arranged in a digital information-providing pattern, said digital information-providing pattern being arranged in a pattern other than a bar code pattern, said digital information-providing pattern being arranged and suitably adapted to be readable before, during and after completion of processing on the wafer”, as recited in independent claim 1.

Further, Bacchi et al. clearly does not disclose a method of encoding information on a semiconductor wafer, which includes, among other features, “...converting the information into a digital form, said digital form being a form other than a bar code pattern; and forming pits suitable for being read before, during and after completion of processing on the wafer corresponding to the digital form of the information in the semiconductor wafer”, as recited in independent claim 37.

Finally, Bacchi et al. clearly does not disclose a system for encoding information on a semiconductor wafer and reading the information, wherein the system includes, among other features, “a plurality of pits formed on the semiconductor wafer in a digital information-providing pattern, said digital information-providing pattern being a pattern other than a bar code pattern, wherein the digital information-providing pattern is adapted and arranged to be readable before, during and after completion of processing on the wafer...”, as recited in independent claim 51.

Although Bacchi et al. is directed to a scribe mark reader which appears may arguably disclose “means for **reading** the information encoded by the pits” (e.g., as found in claim 51), Bacchi et al. is silent on any teaching or suggestion of pits arranged and suitably adapted to be readable before, during, and after completion of processing on the wafer (claims 1 and 51), or the actual process step for **forming** pits suitable for being read before, during and after completion of processing on the wafer (claim 37).

Bacchi et al. is directed to a scribe mark reader which uses a combination of circularly polarized light and a holographic beam-shaping optical element to uniformly illuminate an area of a substrate that includes a scribe mark. By this arrangement, an image of the scribe mark can be formed even when the scribe mark’s optical properties, e.g., coloration, reflectivity, or

transmissivity, for example, are non-uniform, or otherwise degraded.⁸ Further, optical character recognition software is thereby allowed to work more efficiently by producing, in essence, an optical signal with a higher signal-to-noise ratio, in spite of the degraded circumstances of the scribe mark.⁹

In other words, the scribe mark reader of Bacchi et al. appears to overcome and compensate for any deleterious change in optical properties of the scribe mark that may occur. Bacchi et al. is, in no way, associated with physically enhancing or forming the scribe mark or pits themselves, particularly in the manner specifically recited in Appellants' claimed invention.

Furthermore, Bacchi et al. specifically disfavor the claimed enhancement of the scribe marks or pits during formation, due to the stated undesirability in Bacchi et al. of the significant investment required by semiconductor manufacturers to improve or add additional process steps to improve the scribe readability. See col. 2, lines 34-36.

To summarize, Appellants' claimed invention and Bacchi et al. appear to be complementary to each other, i.e., Bachhi et al. has invented a device which appear to be able to read an optical signal produced from the wafer marks of Appellants' invention, and which may also do a good job of reading optical signals produced from non-enhanced pits or scribe marks, and even pits or scribe marks which have had their optical properties degraded to some extent.

Accordingly, as the applied art does not disclose all the recited features of at least independent claims 1, 37, and 51, reconsideration and allowance of claims 1, 37, and 51 are requested.

Further, as dependent claims 2-36, 38-50, 52-56, 58-61, and 63-67 variously and ultimately depend from independent claims 1, 37, and 51 and, consequently incorporate their respective allowable features, these dependent claims are also submitted as being allowable at least on that basis, without recourse to the additional patentable limitations respectively recited.

⁸ See Bacchi et al. at col. 2, lines 57-67, and background discussion of problems at col. 2, lines 10-27.

⁹ See Bacchi et al. at col. 5, lines 19-21.

1. Alternative Arguments for patentability of claims 37, 40, 45, and 63

Claims 37, 40, 45, and 63 do not stand or fall together with independent claims 1 or 51, or with dependent claims 2, 6, 9, 13, 22, 22, 54, 55, 58, and 64.

Bacchi et al. discloses a ***scribe mark reader*** related to illuminating and forming a light pattern representing an identifying mark on a substrate and, in particular, to illuminate and image scribe marks on a semiconductor wafer.¹⁰

With respect to method claim 37, Bacchi et al. in no way discloses a ***method*** which includes “...converting the information into a digital form...other than a bar code pattern; and forming pits suitable for being read before, during and after completion of processing on the wafer corresponding to the digital form of the information in the semiconductor wafer...”

The ***scribe mark reader*** of Bacchi et al. ***does not disclose a method of forming pits***, does not form pits, and does not form pits which are readable after completion of wafer processing. Further, Bacchi et al. does not disclose the actual converting information into a digital form, and then physically embodying the information in pits formed on the wafer as in the claimed invention.

Bacchi et al. merely enhances the readability of pits previously formed by another apparatus, system, or method other than the scribe mark reader of Bacchi et al., by applying optical enhancement techniques to whatever pits or marks are presented.

With respect to dependent claim 40, Bacchi et al. does not disclose a method which provides ***the pits*** with a detectable contrast with respect to surrounding portions of the wafer. If contrast of pits is enhanced to be detectable by the scribe mark reader of Bacchi et al., ***such contrast enhancement is provided by signal processing of detected scribe marks, and not by any method of encoding information on a semiconductor wafer*** as in the claimed invention on

¹⁰ See Bacchi et al. at col. 1, lines 9-12.

appeal. Such signal processing in Bacchi et al. includes differentiating between specularly reflected light from the non-pit areas and scattered light from the pit or scribe mark areas.¹¹

With respect to dependent claim 45, Bacchi et al. does not disclose a method of encoding information on a semiconductor wafer and reading the information represented by the pits, wherein the information is readable by an unaided human eye. Bacchi et al. discloses a scribe mark reader, and does not disclose a method which includes forming pits readable by an unaided human eye.

With respect to dependent claim 63, Bacchi et al. does not disclose a method of encoding information on a semiconductor wafer and reading the information represented by the pits, wherein converting the information into digital form includes converting the information into a non-binary digital form, and wherein forming pits includes forming pits in a plurality of differently oriented oval pits as defined by an orientation of each of an associated major axis thereof.

The scribe mark reader of Bacchi et al. does not convert information into a non-binary digital form, and further does not disclose forming pits. In particular, the scribe mark reader of Bacchi et al. does not disclose forming differently oriented oval pits in the manner claimed.

Therefore, since the applied art does not disclose every recited limitation, reversal of these rejections and allowance of claims 37, 40, 45, and 63 are requested.

2. Alternative Argument for patentability of claims 51 and 54

Claims 51 and 54 do not stand or fall together with independent claims 1 or 37, or with dependent claims 2, 6, 9, 13, 22, 22, 37, 40, 43-45, 55, 60, 63, and 64.

With respect to system independent claim 51, Bacchi et al. in no way discloses *a system for encoding information on a semiconductor wafer* and reading the information, wherein the system includes, among other features, “a plurality of pits formed on the semiconductor wafer in a

¹¹ See Bacchi et al. at col. 3, lines 1-13.

digital information-providing pattern...other than a bar code pattern...[which] is adapted and arranged to be readable before, during and after completion of processing on the wafer..."

As discussed above, Bacchi et al. does not, in any way, disclose the actual encoding of information in pits on a semiconductor wafer.

With respect to dependent claim 54, Bacchi et al. in no way discloses ***a system for encoding information on a semiconductor wafer*** which includes information reading means which comprise at least one linear diode array. Bacchi et al. is silent on the use of linear diode arrays, and instead discloses use of a camera to capture an image which is subsequently converted to a digital format.

Therefore, since the applied art does not disclose every recited limitation, reversal of these rejections and allowance of claims 51 and 54 are requested.

3. Alternative Argument for patentability of claims 55, 60 and 64

Claims 55, 60, and 64 do not stand or fall together with independent claims 1, 37 or 51, or with dependent claims 2, 6, 9, 13, 22, 22, 40, 43-45, 54, 58, and 63.

With respect to dependent claim 55, Bacchi et al. in no way discloses a semiconductor wafer which includes pits which are ***simultaneously*** arranged in both the digital information-providing pattern and in a human-readable pattern.

With respect to dependent claim 60, Bacchi et al. in no way discloses a method of encoding information on a semiconductor wafer which includes simultaneously forming and arranging the pits to correspond to ***both*** a digital form and a human-readable form.

With respect to dependent claim 64, Bacchi et al. in no way discloses a system in which the pits are simultaneously formed in a digital information-providing pattern and in a human-readable form.

Bacchi et al. is silent on disclosing the above limitations. In fact, even if Bacchi et al. disclosed the actual formation of pits or marks, manual reading of the marks is indicated in Bacchi et al. as being labor intensive and susceptible to error.¹²

Therefore, since the applied art does not disclose every recited limitation, reversal of these rejections and allowance of claims 55, 60, and 64 are requested.

B. The Examiner has not established a *prima facie* case of unpatentability of claims 7, 8, 10, 16, 21, 28-30, 33-35, and 38 over Bacchi et al. (US 5,894,348) in view of Duncan (US 4,585,931), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable, and should be reversed.

At the outset, Appellants note that, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, *the prior art reference must teach or suggest all the claim limitations* (emphasis added).¹³ Further, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure.¹⁴

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The deficiencies of Bacchi et al. were discussed in connection with the anticipation rejection, above, of independent claims 1, 37, and 51, among other dependent claims. *Duncan et al. represents the conventional approach for identifying semiconductor wafers using bar code identification indicia*, as discussed in the background section of the present Specification.

Even assuming that the references are properly combinable as suggested by the Examiner, an assumption with which Appellants strongly disagree, as discussed below, Duncan et al. does not

¹² See Bacchi et al. at col. 1, lines 29-31.

¹³ See MPEP §2143.

¹⁴ *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) and See MPEP §2143.

make up for the previously identified deficiencies of Bacchi et al., as discussed above with respect to independent claims 1 and 37.

Specifically, Duncan et al. clearly does not teach or suggest formation or use of a digital information pattern ***other than a bar code pattern***, as variously claimed in independent claims 1 and 37, from which dependent claims 7, 8, 10, 16, 21, 28-30, and 33-35 ultimately and variously depend.

Duncan et al. arguably may form bar code indicia on a semiconductor wafer. However, with respect to the deficiencies of Bacchi et al., and specifically with respect to the claims on appeal, Duncan et al. do not teach or suggest a semiconductor wafer which includes, among other features, “a plurality of pits in the semiconductor wafer, the pits being arranged in a digital information-providing pattern...other than a bar code pattern”, as recited in independent claim 1. Duncan et al. also do not teach or suggest a method of encoding information on a semiconductor wafer which includes, among other features, “converting the information into a digital form...other than a bar code pattern; and forming pits...on the wafer”, as recited in independent claim 37.

Therefore, Appellants submit that Duncan et al. in combination with Bacchi et al. do not teach or suggest all the claimed limitations at least of the independent claim 1 and 37, from which claims 7, 8, 10, 16, 21, 28-30, and 33-35 variously and ultimately depend. Reconsideration and allowance of claims 7, 8, 10, 16, 21, 27-30, 33-35, and 38 are respectfully requested.

2. The Examiner has not established the proper motivation to combine Bacchi et al. with Duncan in the manner suggested, given that Duncan specifically teaches against at least one limitation of the claimed invention.

An essential evidentiary component of an obviousness rejection is a teaching or suggestion or motivation to combine the prior art references.¹⁵ Combining prior art references

¹⁵ *C.R. Bard, Inc. v. M3 Systems, Inc.*, 48 USPQ2d 1225 (Fed. Cir. 1998)

without evidence of a suggestion, teaching or motivation simply takes the inventors' disclosure as a blueprint for piecing together the prior art to defeat patentability – the essence of hindsight.¹⁶

“There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art.”¹⁷ Further with regard to the level of skill of practitioners in the art, there is nothing in the statutes or the case law which makes “that which is within the capabilities of one skilled in the art” synonymous with obviousness.¹⁸ The level of skill in the art cannot be relied upon to provide the suggestion to combine references.¹⁹

Duncan et al. is directed to a technique for solving a particular bar-code readability problem by widening the bar code aspect ratio. As also discussed at page 7 of the Specification, for example, bar codes on semiconductor wafers typically cannot be read after process steps have been completed, and use of bar codes for such semiconductor wafer identification is at least undesirable in this respect. Thus, Duncan et al. teaches away from at least one aspect of Appellants' *claimed* invention, as recited in independent claims 1 and 37.

It is impermissible within the framework of 35 U.S.C. §103 to pick and choose from any one reference only so much of it as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one skilled in the art.²⁰ Further in this regard, As the Court of Customs and Patent Appeals, predecessor to the Federal Circuit, has held:

All relevant teachings of cited references must be considered in determining what they fairly teach to one having ordinary skill in the art. The relevant portions of a reference include not only those teachings which would suggest particular aspects of an invention to one having ordinary skill in the art, but

¹⁶ *Interconnect Planning Corp. v. Feil*, 227 USPQ 543 (Fed. Cir. 1985)

¹⁷ See MPEP §2143.01, citing *In re Rouffet*, 149 F.3d, 1350, 1357, 47 USPQ2d 1453, 1457-8 (Fed. Cir. 1998).

¹⁸ *Ex parte Gerlach and Woerner*, 212 USPQ 471 (PTO Bd. App. 1980).

¹⁹ See MPEP §2143.01, citing *Al-Site Corp. v. VSI Int'l Inc.*, 50 USPQ2d 1161 (Fed. Cir. 1999).

²⁰ *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 230 USPQ 416 (Fed. Cir. 1986).

also those teachings which would lead such a person away from the claimed invention.²¹

The rejections in the Official Action amount, in substance, to nothing more than hindsight reconstruction of Appellants' invention by relying on isolated teachings of the applied art, without considering the overall context within which those teachings are presented. Without benefit of Appellants' disclosure, a person having ordinary skill in the art would not know what portions [of Bacchi et al. and Duncan et al.] to consider, and what portions to disregard as irrelevant or misleading.²²

Duncan et al. is directed toward the improved use of ***bar code indicia*** in semiconductor identification and processing, and ***teaches away*** from at least one aspect of the claimed invention, i.e., a digital information-providing pattern arranged in a pattern ***other than a bar code pattern***, and is submitted as not being properly combinable with Bacchi et al. at least on that basis.

Further, the Examiner's asserted motivation to combine these references, i.e., "...in order to improve the readability of the information mark of the wafer by scattering the rays of light onto the surface of the wafer", is submitted as being deficient on its face, as the semiconductor wafer claim 1 and the method of encoding information onto a semiconductor wafer claim 37 have no stated or reasonably implied need to scatter the rays of light onto the surface of the wafer, as asserted by the Examiner.

While this particular motivating factor for combining references might be reasonable under completely different circumstances with respect to a method of ***reading*** encoded information from the surface of a wafer, neither independent claim 1, directed to a semiconductor wafer, nor independent claim 37, directed to a method of encoding information on a semiconductor wafer, claim or suggest any necessity of "scattering the rays of light onto the surface of the wafer", to improve the performance of an image reader and image readability.

²¹ *In re Mercier*, 185 USPQ 774, 778 (CCPA 1975).

²² *In re Wesslau*, 147 USPQ 391, 393 (CCPA 1965).

Further, Appellants respectfully traverse the Examiner's assertion that the dependent claims which recite particular pit height/width and distance between the pits are obvious in view of the suggested combination of references, since "discovering the optimum or workable ranges involves only routine skill in the art."

Appellants note, however, that the Official Action provides no basis for this statement (why to modify these parameters, and what parameters would be sought to be optimized) and, without more, simply concludes that the present invention would have been obvious in view of the suggested combination. However, Appellants are not aware of any art that discloses a semiconductor wafer with these features, or a method which makes these modifications to the conventional art dimensions. The Official Action's statement and conclusion, without more, is plainly not a sufficient factual basis on which to form any conclusion of obviousness.

If the making recited dimensional relationship is indeed an obvious modification, or if seeking to modify these particular parameters for the disclosed optimization was well known within the art, then citing art (as requested during prosecution), which makes these disclosures, should not have presented any difficulty for the Examiner.

In fact, the recited dimensional relationships act, at least in part, to ensure the readability of the pits formed on the semiconductor wafer before, during, and after further processing steps, as discussed in the present Specification.²³

Therefore, since the applied art is not properly combinable, as discussed above, reversal of these rejections and allowance of claims 7, 8, 10, 16, 21, 28-30, 33-35, and 38 are requested.

3. Alternative Argument for patentability of claims 8, 21, 33, and 38

Claims 8, 21, 33, and 38 do not stand or fall together with dependent claims 7, 10, 16, 28-30, 34, and 35.

²³ See Specification at least at p. 30, line 9 through p. 31, line 6.

With respect to dependent claim 8, Bacchi et al. in combination with Duncan et al. do not teach or suggest that the “plurality of pits comprise pits of a first shape and pits of a second shape”, as recited. Bacchi et al. is a scribe mark reader and does not form “pits”. Duncan et al. uses bar code indicia, and not pits.

With respect to dependent claim 21, Bacchi et al. in combination with Duncan et al. do not teach or suggest pits having at least two different widths, along with all of the other recitations of independent claim 1.

With respect to dependent claim 33, Bacchi et al. in combination with Duncan et al. do not teach or suggest pits having the same widths and at least two different lengths, along with all of the other recitations of independent claim 1.

With respect to dependent claim 38, Bacchi et al. in combination with Duncan et al. do not teach or suggest a method which includes forming a line of pits having two different lengths, wherein the line of pits corresponds to the digital form of the information (which is other than bar-coded information), along with all of the other recitations of independent claim 37.

Therefore, since the applied art, either alone or in combination, does not teach or suggest all the claimed limitations, reversal of these rejections and allowance of claims 8, 21, 33, and 38 are requested.

C. The Examiner has not established a *prima facie* case of unpatentability of claims 11, 12, 17-19, and 41 over Bacchi et al. (US 5,894,348) in view of Young et al. (US 5,792,566), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

Young et al. is directed to improved commercial single crystal wafers, which have a stress concentration notch that allows cleaving the crystal along a desired cleavage plane. Notch 172, offered by the Official Action as disclosing “the pit”, is actually a stress concentration notch formed by longitudinal cut 171. Notch 172 facilitates cleavage of the crystal wafer by concentration of the cleaving forces applied at or near the score line. This cleavage line is cut along the entire length of a single crystal ingot, and is used after sawing the ingot into slices to uniquely define the first and second faces of the wafer. Young et al. does not teach or suggest all the limitations of claims 11, 12, 17-19, and 41.

For example, Young et al. does not teach or suggest “pits...on a side surface of the wafer extending from a front surface of the wafer to a back surface of the wafer”, as recited in dependent claim 11.

Further, and even assuming that the references are properly combinable as suggested by the Examiner, a proposition with which Appellants strongly disagree for the various reasons discussed below, Young et al. does not make up for the previously identified deficiencies of Bacchi et al., as discussed above with respect to independent claims 1 and 37.

In particular, the suggested combination of Bacchi et al. and Young et al. does not teach or suggest a semiconductor wafer, which includes, among other features, “a plurality of pits in the semiconductor wafer, the pits being arranged in a digital information-providing pattern...other than a bar code pattern...arranged and suitably adapted to be readable before, during and after completion of processing on the wafer”, as recited in independent claim 1, from which dependent claims 11, 12, and 17-19 variously and ultimately depend.

Further, the suggested combination of Bacchi et al. and Young et al. does not teach or suggest a method of encoding information on a semiconductor wafer, which includes, among other features, “...converting the information into a digital form...other than a bar code pattern; and forming pits suitable for being read before, during and after completion of processing on the wafer

corresponding to the digital form of the information in the semiconductor wafer”, as recited in independent claim 37, from which dependent claim 41 depends.

Thus, since the applied art, taken alone or in combination, does not teach or suggest all the recited features of independent claims 1 and 37, from which dependent claims 11, 12, 17-19, and 41 variously and ultimately depend, reconsideration and allowance of these claims are, therefore, respectfully requested.

2. The Examiner has not established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Young et al. in the manner suggested, given that Young et al. is directed to the solution of a completely different technical problem than Appellants' claimed invention.

Appellants submit that Young et al. is directed to the solution of a completely different technical problem than both Bacchi et al. and Appellants' claimed and disclosed invention. Young et al. is directed to improved commercial single crystal wafers, which have a stress concentration notch that allows cleaving the crystal along a desired cleavage plane.²⁴

As the Federal Circuit has noted, “[a] reference is not available under 35 USC §103 if it is not within the field of the inventor's endeavor and was not directly pertinent to the particular problem with which the inventor was involved.”²⁵ Therefore, Young et al. is submitted as not being properly combinable with Bacchi et al., at least for that reason, as the motivation to combine these references is submitted as necessarily being deficient.

Furthermore, the Examiner's stated motivation to combine the references “in order to align/stack the wafers by matching the information mark of pits of wafers”, is not grounded in any teaching of the present application, nor in any teaching of Young et al. or Bacchi et al. Therefore, the motivation to combine the references in the manner suggested by the Examiner is submitted as also being deficient, at least for these reasons.

²⁴ See Young et al. at col.

²⁵ *King Instrument Corp. v. Otari Corp.*, 226 USPQ 402 (Fed. Cir. 1985).

Still further, while the Examiner admits that the suggested combination of references fails to teach that the groove is curved on the boule, the Examiner erroneously asserts that “it would have been an obvious design variation well within the ordinary skill in the art...for aligning/stacking the wafer by the matching location of the pits of wafer, and therefore an obvious expedient.” Appellants respectfully traverse this erroneous assertion of obvious design choice.

In similar circumstances relating to claims to an apparatus, “[t]he BPAI held that appellant had simply made an obvious design choice. However, the different structures of appellant and of the reference achieve different purposes.”²⁶ Further, “[t]o require an applicant to include in his specification evidence and arguments regarding whether particular subject matter was a matter of ‘design choice’ would be tantamount to requiring the applicant to divine, before an application is filed, rejections the PTO will proffer. *A finding of ‘obvious design choice’ is precluded where claimed structure and the function it performs are different from those of the prior art.*”²⁷ (emphasis added).

The Federal Circuit, as cited above, in *In re Chu*, precludes a finding of obvious design choice where claimed structure and the function it performs are different from those of the prior art. In appellants’ dependent claim 12, for example, the pits are recited as being on the side surface of the wafer, formed prior to slicing the wafer from the boule by providing diagonal lines in the boule *to provide a unique pattern on each wafer sliced from the boule.*

The Examiner’s statement that the claimed invention is an obvious design variation “by the matching location of the pits of wafer”, directly contradicts the above recitation and the function performed by the recited structure, since “matching” the location of the pits does not teach or suggest providing a *unique pattern* on each wafer.

Therefore, since the applied art is not properly combinable in the manner suggested by the Examiner due to improper motivation to combine, reversal of the unpatentability rejections and allowance of dependent claims 11, 12, 17-19 are respectfully requested.

²⁶ *In re Gal*, 25 USPQ 2d 1076, 1078 (Fed. Cir. 1992).

²⁷ *In re Chu*, 36 USPQ 2d 1089, 1095 (Fed. Cir. 1995).

D. The Examiner has not established a *prima facie* case of unpatentability of claims 23-26 over Bacchi et al. (US 5,894,348) as modified by Duncan (US 4,585,931), in view of Young et al. (US 5,792,566), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be repeated.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Examiner admits that Bacchi et al. and Duncan et al. are deficient with respect to providing a teaching or suggestion of pits being arranged on a back surface of the wafer. The Official Action goes on to assert that Young et al. “teaches the pit (172) is grooved on the side surface of the wafer extending from the front surface of the wafer to a back surface of the wafer when the wafer of Fig. 1 is cut horizontally wherein the pit is perpendicular to a top surface and a bottom surface of the wafer (see Fig. 1-3; col. 2, line 55-col. 4, line 3).”²⁸

Appellants note that the Examiner has improperly invoked the entirety of the “Detailed Description” of Young et al. in asserting this proffered teaching. Such imprecision and lack of specificity in arguments supporting the rejections does not aid in achieving compact prosecution, and appears to not be in accord with the MPEP in this regard.

First of all, stress concentration notch 172, disclosed in Young et al. for crystal cleavage purposes, can not fairly be defined as “pits...arranged in the back surface of the wafer”, as recited in dependent claim 23, as could readily be ascertained from Appellants’ disclosure. By placing pits on a back surface, Appellants’ claimed invention, in one aspect, reduces the effect of semiconductor processing on the pits, and thus helps to improve readability of the pits, in conjunction with other recited features.

²⁸ See Official Action mailed 6/18/03 at p. 5, last paragraph through p. 6, line

Even assuming, *arguendo*, that stress concentration notch 172 is a “pit”, Young et al. would only disclose a pit on a *side surface* of the wafer, and does not disclose, in any fair or reasonable manner, pits in a back surface of the wafer, as claimed in dependent claim 23.

Even assuming that the references are properly combinable as suggested by the Examiner, a proposition with which Appellants strongly disagree for the reasons discussed below, neither Duncan et al. nor Young et al. make up for the previously identified deficiencies of Bacchi et al., as discussed above with respect to independent claim 1.

Thus, the applied art, taken alone or in combination, does not teach or suggest all the recited features of independent claim 1 or dependent claim 23, from which these dependent claims variously and ultimately depend. Therefore, reconsideration and allowance of dependent claims 23-26 are respectfully requested.

2. **The Examiner has not established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Duncan and further with Young et al., given that Duncan specifically teaches against at least one aspect of the claimed invention, and considering that Young et al. is directed to the solution of a completely different technical problem than Appellants' claimed invention.**

As previously discussed in paragraph VIII(C)(2) above, Duncan et al. is submitted as not being properly combinable with Bacchi et al. These arguments will not be repeated in this subsection. Therefore, Appellants submit that the addition of Young et al. also is the result of hindsight analysis, and improper motivation to combine the references in the manner suggested.

The motivation to combine the references in the manner suggested by the Examiner is submitted as being deficient. For example, the Examiner incorrectly asserts that it would have been obvious to a person having skill in the art to incorporate the teachings of Young et al. to the teachings of Bacchi et al. and Duncan et al. in order to align/stack the wafers by matching the information mark or pits of wafers located on the back surface of the wafer, and is therefore an

obvious expedient.²⁹ Appellants respectfully traverse this asserted motivation to combine the references in the manner suggested.

One purpose of Appellants' invention is to ensure readability of information patterns on semiconductor wafers before, during, and after processing. "Matching" information marks or pits of wafers located on the back surfaces of the wafers for alignment purposes is not a stated objective or purpose of Appellants' claimed invention, nor is this matching function fairly taught or suggested by the reference combination. Thus, Appellants submit that the Examiner has engaged in impermissible hindsight analysis in constructing his arguments regarding the motivation to combine the references in the manner suggested.

Therefore, since the applied art is not properly combinable in the manner suggested by the Examiner due to improper motivation to combine, reversal of the unpatentability rejections and allowance of dependent claims 23-26 are respectfully requested.

E. The Examiner has not established a *prima facie* case of unpatentability of claims 14 and 52 over Bacchi et al. (US 5,894,348) in view of Yano et al. (US 6,268,641), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

Yano et al. is directed to a semiconductor wafer having an identification indication on a side surface of the wafer, and a method of manufacturing a semiconductor wafer having such identification indication. The identification indication is disclosed as being a bar code, numeral, or visibly recognizable mark.³⁰ Such identification indication is submitted as being non-digital.

²⁹ See Official Action mailed 6/18/03 at p. 5, first full paragraph.

³⁰ See Yano et al. at col. 3, lines 30-34.

The Examiner offers Yano et al. as disclosing use of a laser device used to read identification mark 16.³¹

Even assuming that the references are properly combinable as suggested by the Examiner, a proposition with which Appellants do not necessarily agree, and even assuming that Yano et al. discloses that for which it is offered by the Examiner, Yano et al. do not make up for the previously identified deficiencies of Bacchi et al., as discussed above with respect to the anticipation rejection of independent claims 1 and 51.

In particular, the combination of Bacchi et al. with Yano et al. does not disclose a semiconductor wafer, which includes, among other features, “a plurality of pits in the semiconductor wafer, the pits being arranged in a digital information-providing pattern...other than a bar code pattern...arranged and suitably adapted to be readable before, during and after completion of processing on the wafer”, as recited in independent claim 1, from which dependent claim 14 depends.

Further, the combination of Bacchi et al. with Yano et al. does not disclose a system for encoding information on a semiconductor wafer and reading the information, wherein the system includes, among other features, “a plurality of pits formed on the semiconductor wafer in a digital information-providing pattern...other than a bar code pattern, wherein the digital information-providing pattern is adapted and arranged to be readable before, during and after completion of processing on the wafer...”, as recited in independent claim 51, from which dependent claim 54 depends.

Accordingly, since the applied art, taken alone or in combination, does not teach or suggest all the limitations of Appellants’ claimed invention, reconsideration and allowance of claims 14 and 52 are requested.

F. The Examiner has not established a *prima facie* case of unpatentability of claims 15, 36, and 42 over Bacchi et al. (US 5,894,348) in view of Brown et al.

³¹ See Official Action at p. 6, paragraph 8, lines 7-8.

(US 5,976,768), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Examiner admits that Bacchi et al. is deficient with respect to providing a teaching or suggestion “that the pits is [sic] coated with silicon **carbide**” (emphasis added).³²

The Official Action goes on to suggest that Brown et al. teaches wafer 2400 having implants 2408 which are separated by space troughs 2802, and a silicon **dioxide** material 3302 which coats and fills the space above the implant and space troughs, asserted as being disclosed by Figs. 31 and 33, and col. 15, line 45-col. 16, line 14.³³

Brown et al., teaches that ***the sidewall material is preferably silicon dioxide***. In spite of a general statement that the sidewall material could also comprise “any other suitable material”, ***Brown et al. completely lacks specific disclosure, as required, that the sidewall material may be either sapphire or silicon carbide***, as specifically claimed in dependent claim 36, for example.

Although Brown et al. appears to disclose placing a layer of silicon **dioxide** sidewall spacer material 3302 ***over gate-edge lightly doped implant 3102***, the claims involved with this particular unpatentability rejection recite, in various forms, providing a coating ***on the surface of the pits***, preferably a sapphire or silicon carbide coating.

Appellants submit that, while sapphire and silicon carbide are recognized for their surface hardness, silicon dioxide, on the other hand, is not believed to be known in the art to have a particularly hard surface characteristic, and is submitted as not being equivalent to silicon carbide or sapphire, at least in terms of surface hardness.

³² See Official Action at p. 7, paragraph 9, lines 5-6.

³³ See Official Action at p. 7, paragraph 9, lines 7-10.

Even assuming that the references are properly combinable in the manner suggested by the Examiner, and further assuming that sidewall material placed over the lightly-doped implant in Brown et al. anticipates coating “pits”, Appellants submit that no fair and reasonable interpretation would find the anticipation in Brown et al. of coating pits with sapphire or silicon carbide, as recited in dependent claims 36 and 42.

Therefore, since the applied art, taken alone or in combination, does not teach or suggest all the limitations of independent claims 15, 36, and 42, or of independent claims 1 and 37, from which these claims variously and ultimately depend, reversal of the rejections and allowance of claims 15, 36 and 42 are requested.

2. The Examiner has not established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Brown et al., given that Brown et al. is directed to the solution of a completely different technical problem than Appellants' claimed invention.

The Examiner admits that Bacchi et al. is deficient with respect to providing a teaching or suggestion “that the pits is [sic] coated with silicon *carbide*” (emphasis added), and that Brown et al. teaches implants 2400 having implants 2408 which are separated by space troughs 2802, and a silicon *dioxide* material 3302 which coats and fills the space above the implant and space troughs.

Although these assertions may be true as far as they go, Appellants point out that Brown et al. is directed to method for forming *sidewall spacers* using frequency doubling hybrid resist, and a device having such sidewall spacers. *Brown et al. is clearly silent as to any disclosure of any information pattern, by pit or otherwise, on any portion of any wafer*, and is directed to the solution of a completely different technical problem than either of Bacchi et al. or Appellants' disclosed and claimed invention. Thus, Appellants submit that these references are not properly combinable, at least for these reasons.

It is impermissible within the framework of 35 U.S.C. §103 to pick and choose from any one reference only so much of it as will support a given position to the exclusion of other parts

necessary to the full appreciation of what such reference fairly suggests to one skilled in the art.³⁴ Further in this regard, As the Court of Customs and Patent Appeals, predecessor to the Federal Circuit, has held:

All relevant teachings of cited references must be considered in determining what they fairly teach to one having ordinary skill in the art. The relevant portions of a reference include not only those teachings which would suggest particular aspects of an invention to one having ordinary skill in the art, but also those teachings which would lead such a person away from the claimed invention.³⁵

The rejections in the Official Action amount, in substance, to nothing more than hindsight reconstruction of (perhaps) only a portion of Applicants' invention by relying on isolated teachings of the applied art, without considering the overall context within which those teachings are presented. Without benefit of Applicants' disclosure, a person having ordinary skill in the art would not know what portions of [Bacchi et al. or Brown et al.] to consider, and what portions to disregard as irrelevant or misleading.³⁶

For example, although Brown et al. appears to disclose placing a layer of silicon dioxide sidewall spacer material 3302 over gate-edge lightly doped implant 3102, the claims involved with this particular unpatentability rejection recite, in various forms, providing a coating *on the surface of the pits*, preferably a sapphire or silicon carbide coating. While sapphire and silicon carbide are known for their surface hardness, silicon dioxide, on the other hand, is not believed to be known in the art to have a particularly hard surface characteristic.

Even if gate-edge lightly doped implants 3102 can, somehow, under some dubious construct, substitute for "pits", Appellants submit that sidewall spacer material 3302, as disclosed in Brown et al. Figs. 33-34, for example, would appear to absolutely *prevent* any information from being read from the asserted "pits". Contrary to the asserted basis for motivation in the Official Action, the disclosed arrangement of Brown et al. does not allow for

³⁴ *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 230 USPQ 416 (Fed. Cir. 1986).

³⁵ *In re Mercier*, 185 USPQ 774, 778 (CCPA 1975).

³⁶ *In re Wesslau*, 147 USPQ 391, 393 (CCPA 1965).

“clear reading of the pits since the coating of the wafer surface prevent dust materials from resting within the pits...” Clearly, dust particles could not “rest” in the pits, because there are no “pits” in Brown et al. for dust to settle in, as the sidewall spacer silicon dioxide material is seen to completely fill sidewall spacer troughs 2802.

Accordingly, even assuming that all the recited limitations are taught or suggested by the suggested combination of Bacchi et al. and Brown et al., the motivation to combine the references is deficient, and therefore are submitted as not being properly combinable. Accordingly, reconsideration and allowance of claims 15, 36 and 42 are requested.

G. The Examiner has not established a *prima facie* case of unpatentability of claims 20, 31, 32, and 39 over Bacchi et al. (US 5,894,348) in view of Iwai (US 4,418,567), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Examiner admits that Bacchi et al. is deficient with respect to providing a teaching or suggestion “that the pits having [sic] a location reference information.”

Even assuming, *arguendo*, that Bacchi et al. and Iwai are properly combinable in the manner suggested by the Examiner, the applied art, neither alone nor in combination, teaches or suggests all the recited limitations of independent claims 1 and 37, from which dependent claims 20, 31, 32, and 39 variously and ultimately depend.

Iwai is directed to a method for manufacturing a semiconductor device having *non-digital alignment or information marks* on a side surface thereof. Based upon the disclosure of Iwai, the information mark may be letters or numerals, or “other characters such as hiraganas, katakanas, and

Greek letters, or symbols such as bar patterns.”³⁷ Iwai does not teach or suggest use of a *digital* information pattern other than a bar code pattern.

Therefore, Iwai in combination with Bacchi et al. do not teach or suggest a semiconductor wafer, which includes, among other features, “a plurality of pits in the semiconductor wafer...arranged in a digital information-providing pattern...other than a bar code pattern, said digital information-providing pattern being arranged and suitably adapted to be readable before, during and after completion of processing on the wafer”, as recited in independent claim 1, and implicitly recited in dependent claims 20, 31, and 32, which depend from independent claim 1.

Further, Iwai in combination with Bacchi et al. clearly do not disclose a method of encoding information on a semiconductor wafer, which includes, among other features, “...converting the information into a digital form...other than a bar code pattern; and forming pits suitable for being read before, during and after completion of processing on the wafer corresponding to the digital form of the information in the semiconductor wafer”, as recited in independent claim 37, from which dependent claim 39 depends.

Accordingly, since the reference combination does not teach or suggest all the recited limitations, reversal of the rejections and allowance of claims 20, 31, 32 and 39 are requested.

H. The Examiner has not established a *prima facie* case of unpatentability of claim 53 over Bacchi et al. (US 5,894,348) in view of Makinouchi et al. (US 4,958,082), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

³⁷ See Iwai at col. 7, lines 21-25.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Examiner admits that Bacchi et al. is deficient with respect to providing a teaching or suggestion that the reading device comprises an interferometer.

Makinouchi et al. is directed to a position measuring apparatus for accurately positioning and measuring position of a mark on a substrate arranged on a moving stage undergoing possible yaw forces. Makinouchi et al. is offered by the Examiner as teaching use of an interferometer.

Further, as previously discussed, Bacchi et al. clearly does not disclose a system for encoding information on a semiconductor wafer and reading the information, wherein the system includes, among other features, “...a plurality of pits formed...in a digital information-providing pattern...[which] is adapted and arranged to be readable before, during and after completion of processing on the wafer...”, as recited in independent claim 51.

Even assuming, *arguendo*, that Bacchi et al. and Makinouchi et al. are properly combinable in the manner suggested by the Examiner, and that Makinouchi et al. discloses that for which it is offered, Makinouchi et al. does not make up for the previously identified deficiency of Bacchi et al., discussed above with respect to independent claim 51.

Accordingly, reversal of the rejection and allowance of claim 53 are respectfully requested.

I. The Examiner established a *prima facie* case of unpatentability of claims 46-50 over Bacchi et al. (US 5,894,348) in view of Moh et al. (US 6,214,250), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Examiner admits that Bacchi et al. is deficient with respect to providing a teaching or suggestion that the pits are altered and invalidated.

Moh et al. is directed to a multilayer, temperature resistant composite label suitable for labeling a substrate, and which preferably includes a ceramic composite and a fired ceramic body having a base layer that includes a glassy phase and a refractory phase, wherein the glassy phase is capable of wetting a substrate at an application temperature. This arrangement is disclosed as providing sufficient color contrast between the top layer and the fired ceramic body such that a code pattern, e.g., a bar code pattern, is optically discernible.

Even assuming that Bacchi et al. and Moh et al. are properly combinable in the manner suggested by the Examiner, a proposition with which Appellants strongly disagree for the reasons discussed below, the applied art, taken alone or in combination, does not teach or suggest all the claimed limitations of independent method claim 37, from which claims 46-50 depend.

In particular, neither Bacchi et al. nor Moh disclose a method of encoding information on a semiconductor wafer, which includes, among other features, "...converting the information into a digital form...other than a bar code pattern; and forming pits suitable for being read before, during and after completion of processing on the wafer corresponding to the digital form of the information in the semiconductor wafer", as recited in independent claim 37.

Accordingly, reversal of the rejection and allowance of dependent claims 46-50 are respectfully requested.

2. The Examiner has not established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Moh et al., given that Moh et al. is directed to the solution of a completely different technical problem than Appellants' claimed invention.

Appellants submit that Moh et al., being directed to the solution of a completely different technical problem than Appellants' disclosed and claimed invention, and also completely different

from the problem solved by the scribe reader of Bacchi et al., is not properly combinable with Bacchi et al.

Moh et al. is directed to composite labels free of heavy metals, and which are usable at high temperatures, e.g. above 400 C, in which the label body includes a glassy phase and a refractory phase. An optically discernible non-digital code pattern is, or can be, formed in a label top layer. Label information is provided in human readable form, e.g., alpha-numeric information, or in a machine-readable bar code form.

As the technical problems are widely disparate, Appellants submit that a person of ordinary skill in the art would not be motivated to combine the teachings of Bacchi et al. with Moh et al. Accordingly, as there is not sufficient motivation to combine the references in the manner submitted, reversal of the rejections and allowance of dependent claims 46-50 are requested.

3. Alternative Argument for patentability of claims 47 and 49.

Claims 47 and 49 do not stand or fall together with dependent claims 46 and 48 and 50.

Moh et al. do not teach or suggest the limitation of dependent claim 47 which includes forming pits during wafer processing to record information about the processing. Moh et al. does not teach or suggest forming pits representing *digital* information other than a bar code pattern.

With respect to dependent claim 49, Moh et al. do not teach or suggest reading pits formed during processing and using the information to determine a subsequent process parameter. Moh et al. does not read “pits”, especially pits which represent digital information arranged in other than a bar code pattern.

J. The Examiner has not established a *prima facie* case of unpatentability of claims 3-5 over Bacchi et al. (US 5,894,348) and Moh et al. (US 6,214,250) in view of Huang et al. (US 5,330,924), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Examiner admits that Bacchi et al. and Moh et al. are deficient with respect to providing a teaching or suggestion that the pits are arranged in an ion implant region to provide a contrast. The Examiner goes on to offer Huang et al. as disclosing ion implantation being used to “characterize” the wafer. Appellants respectfully traverse this assertion, as discussed below.

Huang et al. is directed to a method of making a 0.6 μm word line pitch ROM cell by 0.6 μm technology. The structure resulting from the method of Huang et al. has closely-spaced, self-aligned conductive lines that can be used as word lines for the ROM device.

The Official Action incorrectly interprets the statement in Huang et al. that “[o]nly a single implant is required to characterize the ROM circuit. The characterization is achieved by an ion implant of boron B11 at an energy of between about 130 and 250 keV and a dosage of between about 5 E13 and 5 E14 atoms/cm₂.³⁸ The Examiner appears to confuse the term “characterize the ROM circuit” with the recited “...wherein the pits are arranged in a region...[and] the contrast is provided by ion implant in the region”, as claimed in dependent claim 3.

Appellants submit that there is no reasonable connection or inference to be drawn between “characterizing” the ROM of Huang et al. by ion implantation to “pre-configure” the digital information desired in the ROM, e.g., “01101110”, or other digital sequence, with using Appellants’ recited ion implantation to improve optical contrast and, hence, readability of Appellants’ pits, which are arranged in an information-providing pattern other than a bar code pattern.

There is no teaching or suggestion in Huang et al. of an information providing pattern, as understood and known by persons having skill in the art, in light of Appellants’ disclosure, and there

³⁸ See Huang et al. at col. 4, lines 44-49.

is certainly no teaching or suggestion of the use of contrast, or contrast enhancement of an information providing pattern, as claimed.

Even assuming that the references are properly combinable as suggested by the Examiner, a proposition with which Appellants specifically and strongly disagree as discussed below, the applied art, taken alone or in combination, does not teach or suggest all the claimed features of independent claim 1, as discussed previously with respect to the anticipation rejection of claim 1.

In particular, Huang et al. and Moh et al. in combination with Bacchi et al. do not teach or suggest a semiconductor wafer, which includes, among other features, “a plurality of pits in the semiconductor wafer...arranged in a digital information-providing pattern...other than a bar code pattern, said digital information-providing pattern being arranged and suitably adapted to be readable before, during and after completion of processing on the wafer”, as recited in independent claim 1, and implicitly recited in dependent claims 3-5, which depend from independent claim 1.

Accordingly, reversal of the rejection and allowance of claims 3-5 are requested.

2. The Examiner has not established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Moh et al. and Huang et al., given that both Moh et al. and Huang et al. are directed to the solution of completely different technical problems than Appellants' claimed invention, and also different technical problems from each other.

As mentioned above, Huang et al. is directed to a method of making a 0.6 μ m word line pitch ROM cell by 0.6 μ m technology. The structure resulting from the method of Huang et al. has closely-spaced, self-aligned conductive lines that can be used as word lines for the ROM device.

Appellants submit that Huang et al. and Bacchi et al. are directed to the solution of different technical problems, different still from the technical problem solved by Appellants' claimed invention, and are, at least on this basis, not properly combinable.

The Examiner's stated motivation to combine the references in the manner suggested is that “...[i]t would have been obvious to one of ordinary skill...to substitute the well-known method of

ion implant as taught by Huang with the method of composite label as taught by Bacchi as modified by Moh in order *to provide the conductance to wafer*, and therefore an obvious expedient” (emphasis added).³⁹ Appellants submit that this asserted motivation is not clearly set forth or persuasive, and does not seem to appreciate that, at least in Appellants’ claimed invention, conductive properties of an ion implant, if any, are not relied upon, nor are they even considered.

Instead, in some aspects of the claimed invention, *optical characteristics affecting contrast and readability of the pits are relied upon*, and not any purported “conductance to wafer” effects.

Therefore, Appellants submit that a person having skill in the art would not be motivated to turn to Moh et al. in combination with Bacchi et al. to solve the problem solved by Appellants’ claimed invention.

Accordingly, reversal of the rejections and allowance of claims 3-5 are requested.

K. The Examiner has not established a *prima facie* case of unpatentability of claim 59 over Bacchi et al. (US 5,894,348) in view of Wen (US 5,834,819), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Examiner admits that Bacchi et al. is deficient with respect to providing a teaching or suggestion that the pattern of pits is a quaternary-coded pattern having at least three shapes.

The Examiner admits that Bacchi et al. is deficient with respect to providing a teaching or suggestion that the pattern of pits is a quaternary-coded pattern having at least three different shapes, but offers Wen as teaching that quaternary code is used to encode the data. While Wen clearly uses quaternary coding, this is submitted as being irrelevant to the claimed invention.

³⁹ See Official Action at p. 12, paragraph 15.

Wen teaches a semiconductor read-only memory (ROM) device for permanent storage of multi-level coded data. Wen is not concerned with, in any way, forming pits representing digital information other than a bar-code pattern., and particularly does not teach or suggest *forming differently oriented oval pits* (dependent claim 58) representing quaternary-coded digital information (dependent claim 59).

Even assuming that the references are properly combinable as suggested by the Examiner, a proposition with which Appellants strongly disagree as discussed below, Wen does not make up for the previously identified deficiencies of Bacchi et al., as discussed with respect to the anticipation rejection of independent claim 1.

In particular, Wen combined with Bacchi et al. do not teach or suggest a semiconductor wafer, which includes, among other features, “a plurality of pits in the semiconductor wafer...arranged in a digital information-providing pattern...other than a bar code pattern, said digital information-providing pattern being arranged and suitably adapted to be readable before, during and after completion of processing on the wafer”, as recited in independent claim 1, and implicitly recited in dependent claim 59, which depends from independent claim 1 and dependent claim 58.

Accordingly, as the applied art, taken alone or in combination, does not teach or suggest all the claimed features, reversal of the rejections and allowance of claim 59 are requested.

2. The Examiner has not established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Wen, given that Wen is directed to the solution of a completely different technical problem in a completely different way than Appellants' claimed invention.

The Examiner admits that Bacchi et al. is deficient with respect to providing a teaching or suggestion that the pattern of pits is a quaternary-coded pattern having at least three shapes.

The Examiner goes on to offer Wen as disclosing using a quaternary code to encode the data. While Wen clearly uses quaternary coding, this is irrelevant to the claimed invention, and

Appellants further respectfully traverse the assertion that the reference combination is properly combinable, as discussed below.

On its face, Wen is not properly combinable with Bacchi et al. Wen is directed to a semiconductor read-only memory device for permanent storage of multi-level coded data, preferably using quaternary-coded data with four different values of data. Wen in no way, provides a teaching or suggestion of providing a solution to providing information patterns *on a semiconductor wafer*, and likewise does not disclose, teach or suggest a “pattern”, much less a quaternary-coded “pattern” formed by differently oriented oval pits, as recited in dependent claim 59.

It appears that the Examiner may have lost sight of Appellants’ claimed and disclosed invention which, in no way, relates to a ROM device. Wen is a multi-level memory device, which stores multi-level data by manipulation of threshold voltages, and is not, in any way, involved with providing an information providing pattern in the form of the claimed pits having differently oriented oval shapes.

As Wen solves a completely different technical problem in a completely different way than both Bacchi et al. and Appellants’ claimed invention, Wen is submitted as not being properly combinable with Bacchi et al. at least on that basis.

Even assuming that the references are properly combinable as suggested by the Examiner, a proposition with which Appellants strongly disagree, Wen does not make up for the previously identified deficiencies of Bacchi et al., as discussed with respect to the anticipation rejection of independent claim 1.

Accordingly, as the applied art, taken alone or in combination, does not teach or suggest all the claimed features, reversal of the rejection and allowance of claim 59 are requested.

L. The Examiner has not established a *prima facie* case of unpatentability of claims 56, 57, 61, and 62 over Bacchi et al. (US 5,894,348) in view of Zhang

(US 5,245,165), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Official Action acknowledges that Bacchi et al. is deficient in providing a teaching or suggestion that the pattern of pits comprises at least three shapes, and offers Zhang as disclosing a glyph code having at least three different shapes.

Zhang is directed to a self-clocking glyph code for encoding dual bit digital information on hardcopy recording media, as an interface technology for seamlessly integrating hardcopy documents and computer controlled electronic document processing systems. The self-clocking feature of the glyph codes is embedded in the spatial distribution of the logically ordered glyphs, and this feature increases the tolerance to the degradation, i.e., image distortion and background noise, that these codes might encounter when they are reproduced by photocopying and/or facsimile transmission.

Zhang does not teach or suggest forming a non-binary coded digital information using pits formed using at least three different shapes.

Even assuming that the references are properly combinable as suggested by the Examiner, an assertion with which Appellants strongly disagree as discussed below, Zhang does not make up for the previously identified deficiency of Bacchi et al., at least with respect to independent claims 1 and 37, as discussed above with respect to the anticipation rejection of these claims.

Accordingly, as the applied art, taken alone or in combination, does not teach or suggest all the claimed features, reversal of the rejections, and allowance of claims 56 and 61 are requested.

2. The Examiner has not established that a person with ordinary skill in the art would be motivated to combine Bacchi et al. with Zhang, given that

Zhang is directed to the solution of a completely different technical problem in a completely different way than Appellants' claimed invention.

The Official Action acknowledges that Bacchi et al. is deficient in providing a teaching or suggestion that the pattern of pits comprises at least three shapes, and offers Zhang as disclosing a glyph code having at least three different shapes.

Zhang is submitted as not being properly combinable with Bacchi et al. Zhang is directed to a self-clocking glyph code for encoding dual bit digital information on hardcopy recording media, as an interface technology for seamlessly integrating hardcopy documents and computer controlled electronic document processing systems. The self-clocking feature of the glyph codes is embedded in the spatial distribution of the logically ordered glyphs, and this feature increases the tolerance to the degradation, i.e., image distortion and background noise, that these codes might encounter when they are reproduced by photocopying and/or facsimile transmission.

Zhang has no connection with a semiconductor wafer, or with a method for encoding information on a semiconductor wafer, as in Appellants' claimed invention. Thus, as Zhang is directed to a completely unrelated technical problem than that solved by either of Bacchi et al. or Appellants' claimed invention, Zhang is submitted as not being combinable with Bacchi et al., at least on that basis.

Accordingly, as the applied art is not properly combinable, reversal of the rejections and allowance of claims 56 and 61 are requested.

3. Alternative Argument for patentability of claims 57 and 62.

Claims 57 and 62 do not stand or fall together with dependent claims 56 and 61.

Bacchi et al. combined with Zhang do not teach or suggest all the recited limitations of independent claim 57. Specifically, the applied art does not teach or suggest a semiconductor wafer which includes, among other features, "...pits...arranged in a [non-binary] digital

information-providing pattern...other than a bar code pattern, wherein...the plurality of pits comprise pits having at least three different shapes [including] a circle, an oval, and a rectangle".

Bacchi et al. combined with Zhang do not teach or suggest all the recited limitations of independent claim 62. Specifically, the applied art does not teach or suggest a method of encoding information on a semiconductor wafer which includes, among other features, "converting the information into a digital form...other than a bar code pattern...wherein said step of forming pits includes forming pits in the shape of a circle, an oval, and a rectangle."

There is no teaching or suggestion in Zhang of at least three different shapes which include a circle, an oval, and a rectangle.

Therefore, since the applied art does not teach or suggest all the claimed limitations, reversal of the rejections, and allowance of claims 57 and 62 are requested.

M. The Examiner has not established a *prima facie* case of unpatentability of claims 65-67 over Bacchi et al. (US 5,894,348) in view of Grandia et al. (US 4,084,354), so that the unpatentability rejection under 35 U.S.C. §103(a) is not sustainable and should be reversed.

The relevant case law pertaining to establishing a *prima facie* case of unpatentability is provided above, and will not be duplicated for the sake of brevity.

1. The Examiner has not established that the suggested combination teaches or suggests all the claimed limitations.

The Official Action acknowledges that Bacchi et al. is deficient in providing a teaching or suggestion that the wafer boule has a sequence start notch along a diagonal surface of boule and a helically shaped sequence notches along a longitudinal surface of the boule.

Grandia et al. is directed to a process for slicing boules of single crystal material, in particular, a process for slicing hard single crystal materials such as gadolinium gallium garnet (GGG), which have application in magnetic bubble domain technology.

Grandia et al. is offered by the Examiner as teaching a wafer boule "having the sequence start notches (44) along a longitudinal surface of boule and a helically shaped sequence notches (10) along a longitudinal surface of boule (see Figs. 1A and 4A; col. 1, lines 12-60; col. 3, lines 45-68)."⁴⁰

Whether or not Grandia et al. discloses that for which it is offered by the Official Action, Grandia et al. still does not make up for the deficiencies of Bacchi et al., as discussed with respect to the anticipation rejection of independent claims 1 and 37.

Accordingly, as the applied art, taken alone or in combination, does not teach or suggest all the claimed features, reversal of the rejection and allowance of claims 65-67 are requested.

IX. CLAIMS INVOLVED IN THE APPEAL

A copy of the claims involved in the present appeal is attached hereto as Appendix A. As indicated above, the claims in Appendix A include all previously entered amendments filed by Appellants.

Respectfully submitted,

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⁴⁰ See Official Action mailed 6/18/03 at p. 13, lines 5-8.

APPENDIX A

Claims Involved in the Appeal of Application Serial No. 09/527,761

1. A semiconductor wafer, comprising:

a plurality of pits in the semiconductor wafer, the pits being arranged in a digital information-providing pattern,

said digital information-providing pattern being arranged in a pattern other than a bar code pattern,

said digital information-providing pattern being arranged and suitably adapted to be readable before, during and after completion of processing on the wafer.

2. The wafer according to claim 1, wherein a readability of the pits is provided by the pits having a detectable contrast with respect to surrounding portions of the wafer.

3. The wafer according to claim 2, wherein the pits are arranged in a region of the wafer, wherein the contrast is provided by an ion implant in the region.

4. The wafer according to claim 3, wherein the ion implant is carried out to an implant depth and the pits have a pit depth greater than the implant depth.

5. The wafer according to claim 2, wherein the pits are arranged in a region of the wafer, wherein the detectable contrast is provided by a depth of the pits.

6. The wafer according to claim 1, wherein the digital information providing-pattern comprises at least one of a binary pattern and an alphanumeric pattern.

7. The wafer according to claim 1, wherein the digital pattern comprises long and short pits.

8. The wafer according to claim 1, wherein the plurality of pits comprise pits of a first shape and pits of a second shape.

9. The wafer according to claim 1, wherein the pits are on at least one surface of the wafer selected from the group consisting of a front surface, a back surface, and a side surface.

10. The wafer according to claim 1, wherein the pits are at least 2.5 μm deep.

11. The wafer according to claim 1, wherein the pits are on a side surface of the wafer extending from a front surface of the wafer to a back surface of the wafer.

12. The wafer according to claim 11, wherein the pits on the side surface of the wafer are formed prior to slicing the wafer from a boule by providing diagonal lines in the boule to provide a unique pattern on each wafer sliced from the boule.

13. The wafer according to claim 1, wherein the pits are readable by a reader's eye.

14. The wafer according to claim 1, wherein the pits are readable with a laser reading device.

15. The wafer according to claim 1, further comprising a coating on the surface of the pits.

16. The wafer according to claim 1, wherein the pits have a width of at most approximately 1 mm and a depth of at most approximately 1 mm.

17. The wafer according to claim 1, wherein a bottom surface of the pits is curved.

18. The wafer according to claim 1, wherein at least one of the pits is perpendicular to a top surface and a bottom surface of the wafer.

19. The wafer according to claim 1, wherein at least one of the pits is angled with respect to a line perpendicular to a top surface and a bottom surface of the wafer.

20. The wafer according to claim 1, wherein at least one of the pits has curved sidewalls.

21. The wafer according to claim 1, wherein the pits have at least two different widths.

22. The wafer according to claim 1, wherein the pits are machine-readable.

23. The wafer according to claim 8, wherein the pits are arranged in the back surface of the wafer.

24. The wafer according to claim 23, wherein groups of the pits have the shape of at least one of letters and numbers.

25. The wafer according to claim 24, wherein each group of pits has a width of approximately 2 mm and a height of approximately 5 mm.

26. The wafer according to claim 24, wherein adjacent groups of pits are separated from each other by a distance of approximately 2 mm.

27. The wafer according to claim 24, wherein each group of pits includes a machine-readable set of spaces for pits, each space comprising 2 columns each comprising 32 pits.

28. The wafer according to claim 1, wherein light striking spaces between the pits form interference fringes.

29. The wafer according to claim 1, wherein light striking the pits is not reflected.

30. The wafer according to claim 1, wherein light striking the pits is reflected with a phase change.

31. The wafer according to claim 1, wherein the pits comprise at least one location pit for providing locational reference to a plurality of informational pits.

32. The wafer according to claim 31, wherein the location pit is arranged in a side edge of the wafer and the informational pits are located in a top surface or a bottom surface of the wafer.

33. The wafer according to claim 1, wherein the pits have the same widths and at least two different lengths.

34. The wafer according to claim 33, wherein the pits are arranged in at least one line.

35. The wafer according to claim 33, wherein adjacent pits in a line or in adjacent lines are separated by a distance of at least 5 μm .

36. The wafer according to claim 15, wherein the coating is sapphire or silicon carbide.

37. A method of encoding information on a semiconductor wafer, comprising:

converting the information into a digital form,

said digital form being a form other than a bar code pattern; and

forming pits suitable for being read before, during and after completion of processing on the wafer corresponding to the digital form of the information in the semiconductor wafer.

38. The method according to claim 37, wherein forming the pits comprises: forming a line of pits having two different lengths, the line of pits corresponding to the digital form of the information.

39. The method according to claim 37, further comprising:

forming a reference point, such that the pits are located a predetermined distance from the reference point.

40. The method according to claim 37, further comprising:

providing the pits with a detectable contrast with respect to surrounding portions of the wafer.

41. The method according to claim 37, wherein the pits are formed prior to cutting the wafer from a boule and forming the pits comprises:

forming a first, curved groove in the boule;

forming at least one linear groove in the boule; and

slicing the boule into wafers.

42. The method according to claim 37, further comprising: coating the pits with a coating.

43. The method according to claim 37, further comprising: reading the information represented by the pits.

44. The method according to claim 43, wherein the information is read with a machine.

45. The method according to claim 43, wherein the information is readable by an unaided human eye.

46. The method according to claim 37, wherein said pits are formed before processing of the wafer begins, during wafer processing, or after wafer processing is completed.

47. The method according to claim 46, wherein said pits are formed during wafer processing to record information about the processing.

48. The method according to claim 46, wherein pits previously formed are altered.

49. The method according to claim 46, further comprising the step of reading pits formed during processing and using the information read to determine a subsequent process parameter.

50. The method according to claim 37, wherein pits previously formed are invalidated.

51. A system for encoding information on a semiconductor wafer and reading the information, the system comprising:

a plurality of pits formed on the semiconductor wafer in a digital information-providing pattern, said digital information-providing pattern being a pattern other than a bar code pattern,

wherein the digital information-providing pattern is adapted and arranged to be readable before, during and after completion of processing on the wafer; and

means for reading the information encoded by the pits.

52. The system according to claim 51, wherein the information reading means comprises at least one laser.

53. The system according to claim 51, wherein the information reading means comprises at least one interferometer.

54. The system according to claim 51, wherein the information reading means comprises at least one linear diode array.

55. The semiconductor wafer according to claim 1, wherein the plurality of pits are simultaneously arranged in both the digital information-providing pattern and a human-readable pattern.

56. The semiconductor wafer according to claim 1, wherein the digital information-providing pattern is a non-binary coded pattern, and the plurality of pits comprise pits having at least three different shapes.

57. A semiconductor wafer, comprising:

a plurality of pits in the semiconductor wafer, the pits being arranged in a digital information-providing pattern,

said digital information-providing pattern being other than a bar code pattern,

said digital information-providing pattern being readable before, during and after completion of processing on the wafer,

wherein the digital information-providing pattern is a non-binary coded pattern, and the plurality of pits comprise pits having at least three different shapes, and

wherein the at least three different shapes include a circle, an oval, and a rectangle.

58. The semiconductor wafer according to claim 1, wherein the digital information-providing pattern is a non-binary coded pattern, and the plurality of pits comprise a plurality of differently oriented oval pits as defined by an orientation of each of an associated major axis thereof.

59. The semiconductor wafer according to claim 58, wherein the non-binary coded pattern is a quaternary-coded pattern.

60. The method of claim 37, further comprising simultaneously arranging the pits to correspond both to the digital form and to a human-readable pattern.

61. The system of claim 37, wherein said step of forming pits includes forming pits having at least three different shapes.

62. A method of encoding information on a semiconductor wafer, comprising:
converting the information into a digital form, said digital form being a form other than a bar code pattern; and

forming pits readable before, during and after completion of processing on the wafer corresponding to the digital form of the information in the semiconductor wafer,

wherein said step of forming pits includes forming pits in the shape of a circle, an oval, and a rectangle.

63. The system of claim 37, wherein said step of converting the information into the digital form includes converting the information into a non-binary digital form, and said step of forming pits includes forming pits in a plurality of differently oriented oval pits as defined by an orientation of each of an associated major axis thereof.

64. The system of claim 51, wherein the plurality of pits are simultaneously formed in the digital information-providing pattern and in a human readable form.

65. The method of claim 37, further comprising scribing linear wafer sequence start notch along a longitudinal surface of a boule from which a plurality of semiconductor wafers are subsequently encoded and cut.

66. The method of claim 65, further comprising scribing a plurality of essentially helically-shaped boule sequence notches along the longitudinal surface.

67. The method of claim 37, further comprising scribing a plurality of essentially helically-shaped boule sequence notches along a longitudinal surface of a boule from which a plurality of semiconductor wafers are subsequently encoded and cut.